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PRE-SERVICE ACCOUNTING TEACHERS' CONFIDENCE AND MOTIVATION IN DOING MATHEMATICS

ABSTRACT

The purpose of the study was to determine pre-service accounting teachers' perceptions of the confidence and motivation in doing mathematics in Bachelor of Education Accounting courses at a higher education institution, with the aim of informing higher education heutagogy as it relates to teaching and learning in accounting. This study included a convenience sample of 255 pre-service accounting teachers from a higher education institution in South Africa and a purposive sample of 18 students was drawn. Data collection was done through questionnaires and an interview schedule. A sequential explanatory design and sampling were employed. Data were analysed using SPSS for quantitative data and the interviews were transcribed and analysed qualitatively. The mean scores are above average (positive) for the cohort, however, there were numerous students with low scores in the effectance motivation and confidence scales. A more positive attitude towards effectance motivation in doing mathematics came from Indian, English and suburban respondents (p<.050). These students were not discouraged by difficult mathematical problems and are thus motivated by the challenges of mathematics. The interviews showed that parents positively influenced these students to persevere when faced with challenging mathematics problems. The results show no significant differences in the confidence in doing mathematics subscale (p >.050) in relation to gender, age, race group, mother tongue, Grade 12 mathematics, accounting module or location of schools. This finding runs counter to interview responses where 10 of the participants did not believe that they had a lot of self-confidence when it comes to mathematical accounting calculations and could not do advanced work without seeking help from others, compared with 6 participants who agreed that they had a lot of self-confidence when it comes to mathematical accounting calculations and could do advanced work without seeking help from others. In third-year accounting, strong significant connections were found between motivation in doing mathematics, confidence in doing mathematics and achievement in Accounting 420.

Keywords: *Pre-service teachers; accounting; mathematics; confidence; motivation; teaching.*

1. INTRODUCTION

There is a limited understanding of the nature of the relationship between mathematics and accounting (Yunker *et al.*, 2009, Mkhize, 2019) and the extent to which mathematics influences the teaching and learning of accounting. Accounting students perform a variety of calculations in accounting courses. This makes mathematics integral to the successful study of accounting. The majority of accounting definitions assert that accounting requires numerical and analytical skills, which are also integral elements of mathematics (Shaftel & Shaftel, 2005, Fedoryshyn *et al.,* 2010, Heck & van Gastel, 2006). The transition from basic education to higher education mathematics modules, which involve advanced mathematics, is a challenge for many students (Rach & Ufer, 2020, Heck & van Gastel, 2006). The new entry students who fail to master basic skills, such as solving arithmetic and algebra problems, will most likely face difficulties in their further modules (Nortvedt & Siqveland, 2018). Undergraduate accounting students with majors in mathematics from pre-university institutes perform better than those with arts or social sciences backgrounds (Zandi, Shahabi & Bagheri, 2012). Number and operations, patterns and algebra, and data handling and probabilities skills that can be acquired in the subject of mathematics are found to be useful in accounting courses. It is vital to have mathematics skills to complete accounting tasks or activities as they are full of basic and advanced calculations and report accurate financial information (Mkhize, 2019, Villamar *et al.,* 2020). This study was driven by the need to investigate pre-service teachers' perceptions of the confidence and motivation in doing mathematics in Bachelor of Education Accounting courses at the higher education institution (HEI), with the aim of informing higher education heutagogy as it relates to teaching and learning in accounting. The research questions of this study were formulated as follows:

- What are the pre-service teachers' perceptions of the confidence and effectance motivation in doing mathematics in BEd Accounting courses?

  This question is answered in two ways: firstly, by looking at the confidence and motivation in doing mathematics domains and reviewing questions in the interview instrument and secondly, by examining groupings and determining if one can draw some significant differences in the perceptions of students across demographic variables as they relate to mathematics confidence and effectance motivation.

- How do confidence and effectance motivation in doing mathematics relate to learning and achievement in accounting? The question is answered by looking at the correlation between dimensions of motivation and confidence in doing mathematics and achievement in accounting modules.

2. LITERATURE REVIEW

2.1 Confidence in learning mathematics

Hurst (2012) points out that confidence and positive self-efficacy can be a positive step towards success in any discipline. In his study, Hurst found that one method to increase student confidence and interest in mathematics was to "humanise" it, make the history of mathematics a key aspect of the module – for example, asking the students to undertake research on the history of a concept they are learning. Another study, by Hoffman and Schraw (2009), reported that students with higher mathematics self-efficacy persist longer with difficult mathematics problems and are more accurate in mathematics calculations than those lower in mathematics self-efficacy. In addition, Wenner (2001) found that the self-efficacy beliefs of in-service teachers – in particular, science and mathematics teachers – tend to be higher than those of pre-service teachers in other non-science or mathematics disciplines and that pre-service teachers should be the targeted population for intervention. Pajares and Schunk

(2001) emphasise that students with low self-efficacy beliefs tend to be less confident and consequently become more anxious and stressed when attempting tasks.

Canada (2011), who examined the mathematics attitudes of African-American elementary students, found that African American students in this sample enjoyed mathematics significantly more than White students and perceived themselves in mathematics at the same level, regardless of teachers underrating them and overrating their White counterparts on both measures. A study by Curtis (2006) found a significant difference in enjoyment of mathematics on college students' race. No significant differences were found in confidence in doing mathematics, motivation in doing mathematics and value of mathematics. The qualitative data showed that a change occurred in confidence in doing mathematics, motivation in doing mathematics and value of mathematics. The study also identified that cooperative learning, problem solving, discourse and graphing calculators increased students' confidence in doing mathematics, and that students felt more competent in performing problems during examinations. Similarly, Farooq and Shah (2008), investigating high school students' attitudes towards mathematics, found no significant difference in confidence in doing mathematics between male and female students (t-value = 1.276; $p > 0.05$).

2.2 Effectance motivation in learning mathematics

According to self-determination theory (Deci & Ryan, 2000; Deci & Ryan, 1985), motivation can be divided into three broad categories: *amotivation*, *extrinsic motivation* and *intrinsic motivation*. The three categories exist on a continuum according to the level of self-determination underlying the motives behind behaviours. Amotivation occurs when individuals feel that an activity has no value, when individuals do not feel competent to complete a task or do not expect any desirable outcome from the activity. Extrinsic motivation is the desire or drive to engage in an activity because it leads to the attainment of an unrelated outcome (Eccles & Wigfield, 2002; Ames, 1992; Deci, 1972). External regulation is caused by external imposed rewards or punishments. Introjection occurs when individuals internalise the reasons for their behaviours and impose their own rewards or constraints. Identification occurs when an individual identifies with reason for behaving in a particular manner and behaviour is valued by the individual and occurs because the individual chooses to do so (Deci & Ryan, 1985; Deci & Ryan, 2000). Extrinsically motivated students engage in academic tasks because of rewards, such as recognition or pressures and failure (O'Keefe, 2010). Intrinsic motivation refers to an inner desire to accomplish a task, and pleasure is derived in the process. Intrinsically motivated students engage in academic tasks because they have an interest in studying and enjoy tasks or activities. Students have an intrinsic motivation to know, to accomplish tasks and to experience stimulation (Deci & Ryan, 2000).

Instruction that supports developmental students to develop a positive self-concept, self-efficacy, independence and engagement will be beneficial in increasing student motivation (Hannula, 2002). The application of sound teaching and learning principles fosters an environment where students are motivated to reach for their potential (Tsanwani, 2009). Motivation to achieve in mathematics is not solely a product of mathematics ability nor is it so stable that intervention programmes cannot be designed to improve it (Middleton & Spanias, 1999). Instead, achievement motivation in mathematics is strongly influenced by instructional practices, and, if appropriate practices are implemented consistently over a long period of time, students can and do learn to enjoy and value mathematics (Middleton & Spanias, 1999, Posamentier, 2017). Teaching mathematics based on action learning and natural motivation is effective. Incorporating stimulating questions, computer analysis (internet search included), and classical famous problems are important motivating resources in mathematics, which are particularly beneficial in the framework of action learning (Abramovich *et al.,* 2019). Vandecandelaere *et al.* (2012) posit that the learning environment is linked with the motivation that comes with enjoying the challenges in mathematics.

A study by Noble (2011) investigated the personal stories of African American male students who excelled in mathematics to understand the impact of their self-efficacy beliefs on their motivation and subsequent academic achievement in mathematics at the post-secondary level, and reported that enactive attainment and vicarious experience were influential sources for these students' beliefs and were supported by family, friends and peers. The vicarious experiences seemed to be more influential than enactive attainment. This finding challenges Bandura (1986), who found that enactive attainment has the most significant influence on self-efficacy. Instead, Noble's finding supports claims that friends play a major role in the development of attitudes to academics for African American male students. A study by Aruwa (2011) on influences on attitudes towards mathematics found that participants' own motivational orientations, their belief about their mathematical ability, and the reasons they gave for success and failure appeared to have influenced their achievement and attitudes towards mathematics. The presence of an extrinsic achievement goal, especially in the later stages of secondary school, appeared to have motivated participants to strive for mathematical achievement. Anthony (2000) found that self-motivation influenced success in mathematics subjects and that lack of effort was the most likely factor to influence failure in mathematics subjects.

Finally, a study by Frazier-Kouassi (1999) found a significant difference between high-achieving and low-achieving groups ($t=-3.02$; $p=.003$). High-achieving students had a more positive mean score than low-achieving students, meaning that they agreed more strongly on the statement "challenges of mathematics motivate" me than did low-achieving students. Additionally, these students may be intrinsically motivated or have a history of positive reinforcement from parents or teachers for persistence in the face of difficulty.

2.3 Integration of mathematics in accounting

Integration is the act, process or an instance of integrating. For example, the *integration* of mathematics and/with accounting (Merriam-Webster, 1999). An integrated study is one in which students broadly explore knowledge in various subjects related to certain aspects of their environment (Humphreys *et al.,* 1981). Interdisciplinary integration is when students learn concepts and skills from two or more disciplines that are tightly linked to deepen knowledge and skills. Teachers arrange the curriculum around common knowledge or learnings throughout disciplines and break apart or chunk together the common knowledge or learnings embedded in the disciplines to emphasise interdisciplinary skills and concepts (Drake & Burns, 2004; Kaufman *et al.,* 2003), as illustrated in Figure 1 below However, Mwakapenda and Dhlamini (2010) state that some tensions that students may face is where opportunities for making connections between mathematics and other learning areas are available but are either neglected or inappropriately used by the teachers.

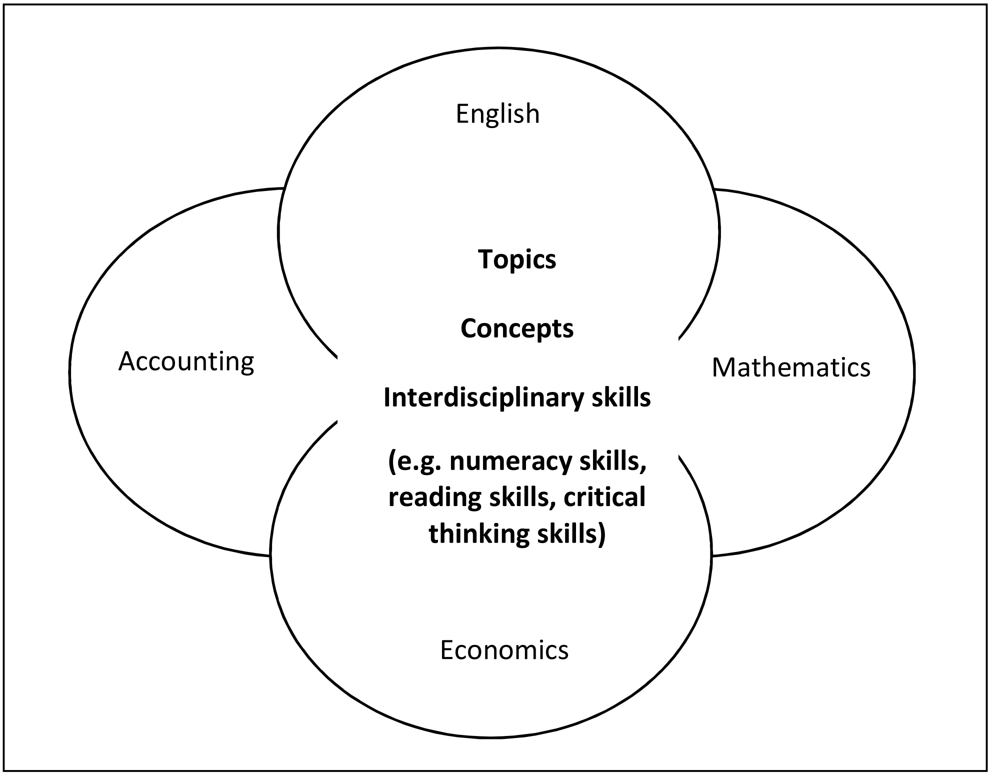


Figure 1. The interdisciplinary integrated approach (Drake & Burns, 2014).

Accounting activities require the use of mathematics or mathematical principles to successfully complete any introductory accounting courses or modules (Babalola & Abiola, 2013). The rules of debits and credits are entirely based on mathematical logic. There is a need for learning accounting from the perspective of mathematics (Warsono, Darmawan & Ridha, 2009). Selesho (2000) concurs that mathematics plays an important role in learning accounting. Studies by Yu (2011) and Zandi, Shahabi and Bagheri (2012) found that mathematics proficiency is the factor that has the biggest impact on accounting students' output performance. A study by Stenberg, Varua and Yong (2010) suggested that tertiary institutions should recognise that high failure rates are due to inadequate mathematics exposure in secondary schooling, and corrective actions such as remedial lessons might not be sufficient. Specifying a minimum mathematics entry requirement and/or providing foundation programmes to ensure students have the essential basic mathematical skills, would increase student success in quantitative courses or modules.

3. METHODOLOGY

3.1 Research design and sampling

A pragmatic, sequential explanatory mixed methods research design and sampling were adopted for this study and included a sequential collection of quantitative and qualitative data to provide answers to the research questions. For the first phase, convenience sampling was used for the surveys, because the pre-service accounting teachers are based at the HEI and are easy to reach and easy to contact. The randomly selected quantitative sample size consisted of 225 pre-service teachers. For the second phase, a purposeful choice sample for interviews was randomly selected from the quantitative sample. This sampling method was relevant for the study since pre-service accounting teachers elaborated on their quantitative responses. The qualitative sample size consisted of 18 pre-service accounting teachers (6 students from each first-, second- and third-year level of study).

3.2 Data collection methods

The two data collection methods used to source the information were questionnaires and interviews.

3.2.1 Questionnaires

The questionnaires were used to collect quantitative data. The composite statement for the confidence in doing mathematics scale is "I am confident in doing mathematics". The composite statement for the motivation in doing mathematics scale is "The challenges of mathematics motivate me". The scales consisted of 12 statements each. The first six statements measure positive attitudes, and six measure negative attitudes, with the following possible responses: strongly agree, agree, neutral, disagree, and strongly disagree. Each of the Likert responses was given a value of 5 to 1 respectively, for the positively stated questions, and 1 to 5 respectively, for the negatively stated questions. A minimum possible score was 12 and the maximum possible score was 60. A higher score indicates a more positive attitude towards the confidence of learning mathematics and effectance motivation. A lower score indicates a more negative attitude towards the confidence of learning mathematics and effectance motivation. The questionnaires adapted from the Fennema-Sherman Confidence and Motivation of doing Mathematics Scales were pilot tested. The reliability test was confirmed by determining the Cronbach's Alpha for the scales. The confidence in learning mathematics scale reliability coefficient of $r = 0.922$ was found and Effectance motivation scale reliability coefficient of $r = 0.847$ was found.

3.2.2 Interviews

The interview schedule was constructed from Fennema-Sherman Confidence and Effectance Motivation in doing Mathematics Scales and from literature identified and developed in the literature review.

A number of the interview questions were posed as follows: "I have a lot of confidence when it comes to mathematical accounting calculations and could do advanced work in mathematics without seeking help from others", "Watching and listening to a teacher in an accounting class performing an algebraic equation or applying a formula on the chalkboard makes me feel happy". Do you agree with these statements? The 5-point Likert scale was used and students were required to explain during the interview. Open-ended questions were asked so that participants could express their views (Figures 1 and 2).

I have a lot of confidence when it comes to mathematical accounting calculations and could do advanced work in mathematics without seeking help from others.

I have a lot of confidence when it comes to mathematical accounting calculations and could do advanced work in mathematics without seeking help from others.

Do you agree with the statement?

Strongly agree	Agree	Undecided	Disagree	Strongly disagree

If agree, why? _________________ Explain: ____

If disagree, why not? ____

Figure 1: Example of a Likert-scale question used in a survey via interview

Watching and listening to a teacher in an accounting class performing an algebraic equation or applying a formula on the chalkboard makes me feel happy.

Do you agree with the statement?

Strongly agree	Agree	Undecided	Disagree	Strongly disagree

Explain: ____

Figure 2: Example of a Likert-scale question used in a survey via interview

The interviewer pre-tested the survey via interviews with two pre-service accounting teachers at the HEI School of Education to confirm whether the interviewees understood the questions.

3.2.3 Procedures

Survey: The questionnaire was administered during the accounting class. The instructions in English were read to the participants. The participants were assured that the data was for academic research only. No identifying information was to be disclosed on the questionnaire, and for this reason the questionnaire was conducted anonymously. Participants were told that pseudonyms would be used. Participants were also given assurance that their participation or non-participation would not affect their marks or disadvantage them in any way, even though the researcher was the accounting lecturer. This gave respondents the assurance of confidentiality and anonymity. A consent form was distributed for the participants to complete. Questionnaires were also distributed, and participants were given 45 minutes to fill it in. Two research assistants assisted in collecting the questionnaires.

Interviews: The office was used because it is situated in a quiet area. No interruptions occurred. The individual face-to-face open-ended interviews with 18 pre-service accounting teachers were conducted. The instructions in English were read to the participants. The 18 participants were asked to indicate their perceptions of confidence in learning mathematics and effectance motivation in Bachelor of Education accounting courses at the higher education institution. The interviews were recorded and notes taken. Permission was obtained from participants before commencing.

3.3 Data analysis strategy

The quantitative data were analysed using SPSS. Descriptive and inferential statistics were computed. Mean scores of students falling in each category were calculated. Box and whisker plotting showed the overall means to conceal the key differences between individual student responses. The t-test and analysis of variance were used to test whether there was a significant difference between demographic variables and students' confidence in doing mathematics and effectance motivation, significance level, $p < 0.05$. Pearson correlations computed for confidence in doing mathematics and effectance motivation and accounting mark sheets in order to investigate which of the affectance factors correlate, whether positively or negatively. Statistical significance was found to be at $p < 0.01$ and $p < 0.05$.

The interview data were transcribed to produce a written word document. The interview participants were emailed data to verify their responses. The responses were coded and salient items categorised into themes. To enhance the credibility of the analyses, member checks were performed by supervisors, academics with doctorate degrees at a workshop and two retired education professors.

3.4 Ethical considerations

The research complied with ethical considerations for dealing with human subjects. Ethical clearance was obtained from Human Research Ethics Committee of the relevant higher education institution.

4. RESULTS

Quantitative and qualitative results are explained below.

4.1 Quantitative results

4.1.1 Descriptive statistics

Cronbach's Alpha coefficient for confidence in doing mathematics was .922 and effectance motivation in doing mathematics was .847. The mean score showed the overall effectance and motivation in doing mathematics of all 255 students. A mean equal to 36 indicated that effectance and motivation in doing mathematics is neutral, mean less than 36 (below average) indicated that students were in disagreement with the composite statement and the mean greater than 36 (above average) indicated that students agreed with the composite statement. Table 3 indicates that the mean values were above average for both the factors: Confidence in doing mathematics – the mean score for all 255 respondents was 41.57 (SD = 11.01) which represents moderate agreement with the composite statement, "I am confident in doing mathematics" and effectance motivation in doing mathematics – the mean score for all 255 respondents was 40.13 (SD = 9.28), which represented moderate agreement with the composite statement, "The challenges of mathematics motivate me".

Table 1. Mean scores and standard deviations for the personal affect factors

Factor (N=255)	Mean	Std. Deviation	Cronbach Alpha
Confidence in doing mathematics	41.57	11.013	.922
Effectance motivation in doing mathematics	40.13	9.275	.847

The overall means cited in the previous paragraph conceal the key differences between the individual student responses. As shown in Figure 3, the spread of factor and mean scores for students are depicted.

I – First year students:

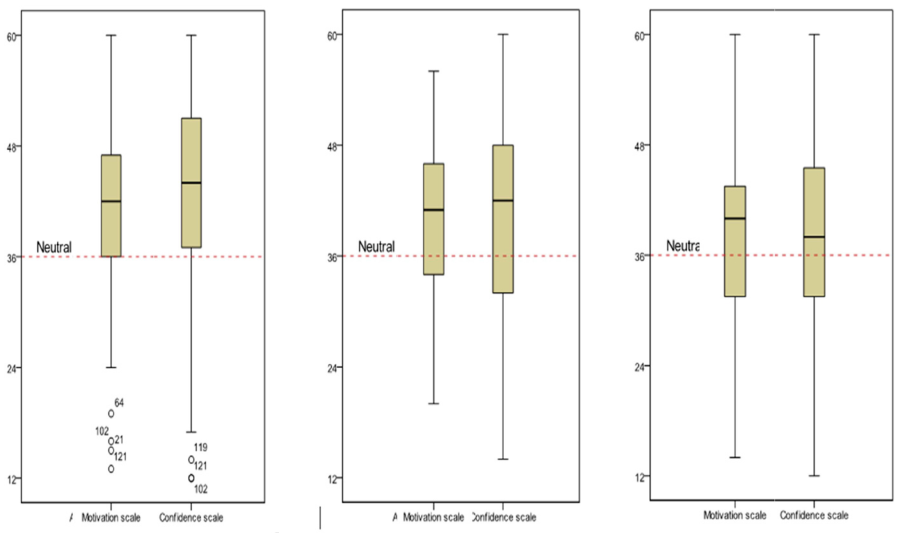
The large number of outliers indicated the diversity in the class. Most of the students in the first year agreed with statement, "the challenges of mathematics motivate me" and "I am confident in doing mathematics". Despite the mean score being positive (above average) for the cohort, there were numerous students who had achieved low scores in the factors.

II – Second year students:

These students also had low scores in the motivation and confidence factors despite the mean being positive.

III – Third year students:

It was noted that from the means for third-year accounting students scored lower than the means for first- and second-year accounting students.



I – First year students **II** – Second year students

III – Third year students

Figure 3: Spread of factor and mean scores for accounting students, Fennema-Sherman Motivation and Confidence in doing Mathematics Scales

Inferential statistics

Effectance motivation in doing mathematics

Table 2 shows the number of students selecting each level of agreement on effectance motivation in doing mathematics. Table 3 shows the data disaggregated by gender, age, race, mother tongue, mathematics schooling background, year of study and location of schooling.

Table 2. Number of students selecting each level of agreement on effectance motivation in doing mathematics

Effectance motivation in doing mathematics subscale (N = 255)	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
	n	n	n	n	n
I like maths puzzles.	47	100	46	40	22
Maths is enjoyable to me.	43	84	42	61	25
When a maths problem comes up that I cannot solve right away, I stick with it until I find the solution.	57	99	30	43	26
Once I start working on a maths puzzle, it is hard to stop.	35	66	39	70	45
When I have a question that doesn't get answered in maths class, I keep thinking about it.	58	100	28	43	26
I am challenged by maths problems I cannot understand right away.	54	93	31	59	18
Figuring out maths problems is not something I like to do.	30	48	42	97	38
The challenge of maths problems does not appeal to me.	15	41	74	85	40
Maths puzzles are boring.	14	24	61	92	64
I do not understand how some people can spend so much time on maths and seem to like it.	33	42	40	85	55
I would rather have someone else figure out a tough maths problem than have to work it out myself.	32	48	44	65	66
I do as little work in maths as possible.	28	68	29	72	58

Table 3. Comparison: effectance motivation in doing mathematics with demographic variables using means, T-test and ANOVA

Variables	**Sub-groups**	**N**	**Mean**	**T-test**			**ANOVA**		
				T	**Df**	**P**	**f**		**p**
Gender	Male	105	39.52	-.872	253	.384			
	Female	150	40.55						
Age (years)	18 – 20 years	165	40.50	.871	253	.385			
	21 years and above	90	39.44						

Variables	Sub-groups	N	Mean	T-test			ANOVA		
				T	Df	P	f		p
Race group	African Indian	225 30	39.56 44.40	-2.718	253	.007*			
Mother tongue	English Zulu	32 223	44.50 39.50	2.891	253	.004*			
Grade 12 mathematics	Mathematics Mathematical Literacy	146 109	40.86 39.16	1.451	253	.148			
Accounting module	First year Second year Third year	143 77 35	40.97 39.35 38.43				1.445		.238
Areas/ location of school	Rural area Township area Suburban area	134 72 49	39.75 38.32 43.84				5.595		.004*

*p<0.05

The significant differences were between African and Indian, English and Zulu, and rural, township and suburban students ($p < 0.050$).

Confidence in doing mathematics

Table 4. Number of students selecting each level of agreement on confidence in doing mathematics

Confidence in doing mathematics domain (N = 255)	Strongly agree	Agree	Undecided	Disagree	Strongly disagree
	n	n	n	n	n
I feel confident trying maths.	95	92	27	27	14
I am sure that I could do advanced work in maths.	73	83	54	31	14
I am sure that I can learn maths.	89	113	34	10	9
I think I could handle more difficult maths.	55	77	67	26	30
I can get good marks (scores) in maths.	57	121	39	25	13
I have a lot of self-confidence when it comes to maths.	52	75	52	59	17
I am no good at maths.	31	47	35	91	51
I do not think I could do advanced maths.	21	46	42	97	49
I am not the type to do well in maths.	22	37	30	110	56
For some reason, even though I study, maths is really hard for me.	39	72	34	66	43
I do fine in most subjects, but when it comes to maths I really mess up.	62	53	21	72	47
Maths is my worst subject.	47	39	36	59	73

Table 4 shows the number of students selecting each level of agreement on confidence in doing mathematics. Table 5 shows the data is disaggregated by gender, age, race, mother tongue, mathematics schooling background, year of study and location of schooling.

Table 5. Comparison: confidence in doing mathematics with demographic variables using means, T-test & ANOVA

Variables	**Sub-groups**	**N**	**Mean**	**t-test**			**ANOVA**	
				T	**Df**	**P**	**f**	**P**
Gender	Male	105	41.86	.349	253	.727		
	Female	150	41.37					
Age (years)	18 -20 years	165	42.07	.978	253	.329		
	21 years and above	90	40.66					
Race group	African	225	41.40	-.687	253	.493		
	Indian	30	42.87					
Mother tongue	English	32	43.47	1.044	253	.298		
	Zulu	223	41.30					
Grade 12 mathematics	Mathematics	146	42.38	1.358	253	.176		
	Mathematical Literacy	109	40.49					
Accounting module	First year	143	42.91				2.656	.072
	Second year	77	40.31					
	Third year	35	38.86					
Areas/ location of school	Rural area	134	40.86				1.785	.170
	Township area	72	41.08					
	Suburban area	49	44.22					

*p<0.05

The results of the study show no significant differences between any of the grouping variables ($p > 0.050$).

Correlation between effectance motivation and confidence in doing mathematics scores and achievement in accounting modules

This section answers the question: How do personal factors (confidence in doing mathematics and motivation in doing mathematics) relate to learning and achievement in accounting?

Table 6. Correlation between dimensions of motivation and confidence in doing mathematics and achievement in accounting modules

			Motivation subscale	**Confidence subscale**
First year	Accounting 210	Pearson correlation	.248**	.227*
		Sig. (2-tailed)	.005	.010
		N	128	128
	Accounting 220	Pearson correlation	.241*	.229*
		Sig. (2-tailed)	.010	.015
		N	112	112
Second year	Accounting 310	Pearson correlation	.178	.098
		Sig. (2-tailed)	.167	.449
		N	62	62
	Accounting 320	Pearson correlation	.178	.075
		Sig. (2-tailed)	.203	.591
		N	53	53
Third year	Accounting 410	Pearson correlation	.327	.339
		Sig. (2-tailed)	.072	.062
		N	31	31
	Accounting 420	Pearson correlation	.506**	.437*
		Sig. (2-tailed)	.007	.023
		N	27	27

** Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

The correlations between factors of motivation and confidence in doing mathematics and achievement in accounting modules studied in the year of the research have been calculated. The results were tabulated in Table 6 and it should be noted that six different modules of accounting were used to measure accounting achievement. This affects the comparability of the results across the year groups, the two modules in the current year of study; nevertheless, certain trends could be observed. The study revealed the following aspects: In first-year accounting, there were low positive and significant correlations between motivation in doing mathematics and confidence in doing mathematics. This indicated a marginal connection between accounting 210 and 220 achievement and motivation in doing mathematics as well as confidence in doing mathematics. In second-year accounting, no significant correlations were found between motivation and confidence in doing mathematics and achievement in Accounting 310 and 320. In third-year accounting, strong significant connections were found between motivation in doing mathematics, confidence in doing mathematics and achievement in Accounting 420.

4.2 Qualitative results

Interviews on confidence in doing mathematics

Figure 4 shows the responses of participants to the question “I have a lot of confidence when it comes to mathematical accounting calculations and could do advanced work in mathematics without seeking help from others. Do you agree with this statement?”. The results indicated that the majority of participants disagreed with the statement.

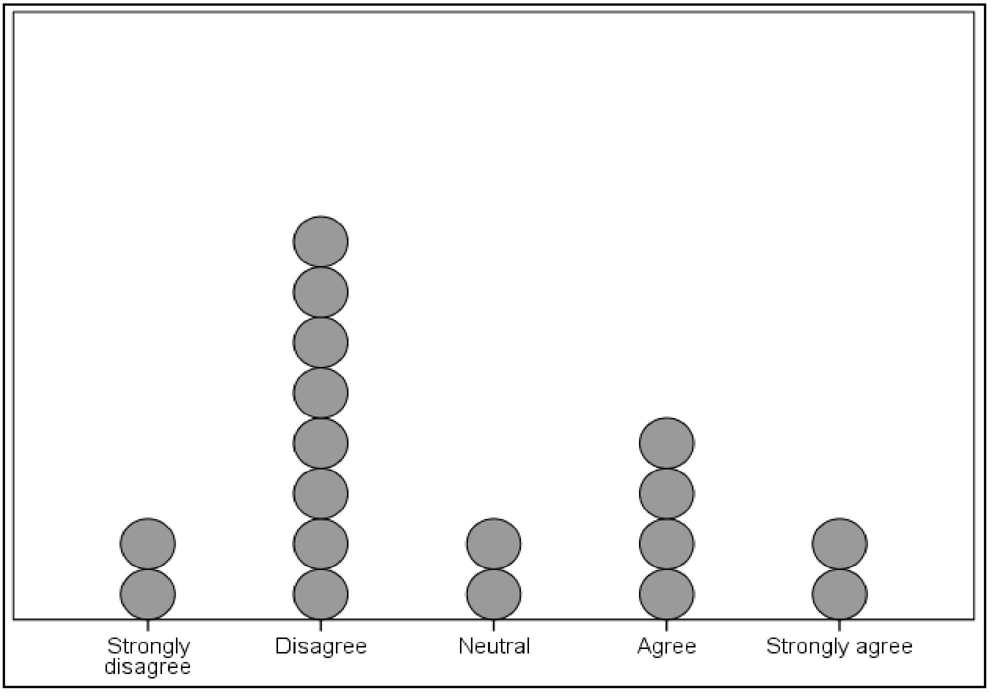


Figure 4. Confidence in mathematical accounting calculations.

Explanations given by the participants:

> I have self-confidence when it comes to doing calculations and I like to do advanced work so that when we are doing it in class I am already prepared. Although when I find challenges I often seek help but not always (Sibo).

> I have confidence I enjoy mathematics and challenges. I sometimes find challenging, that is when I need help (Narri).

> Mathematics is one of my favourite subjects and I do it myself most of the times. I seldom ask people for help (Madu).

> I understand most of the calculations. Occasionally I ask for help from others Sisi.

These are exceptional cases that were found. They were confident and enthusiastic in doing mathematical accounting calculations but were not free from anxiety as they sometimes found it challenging and sought assistance.

> I find mathematics challenging so if the mathematical accounting calculation is challenging I get lost and confused and not confident in doing it … as long there is someone to assist (Vender).

> Not confident, mathematical accounting calculations are challenging. In most of the times I seek help if lost (Kazi).

Vender and Kazi indicated that mathematics anxiety affects confidence and lack of confidence affects mathematics anxiety in doing mathematical accounting calculations.

> I do need help most of the times because I did mathematics literacy in high school level (Buthu).

Buthu is not confident in doing Mathematics as he did Mathematical Literacy in high school. He always looks for assistance.

Interviews on effectance motivation in doing mathematics

Most of the participants (15) agreed with the statement, "I get motivated towards practising mathematical accounting calculations when I successfully solve the accounting problem". Only a minority of participants (3) disagreed with this statement.

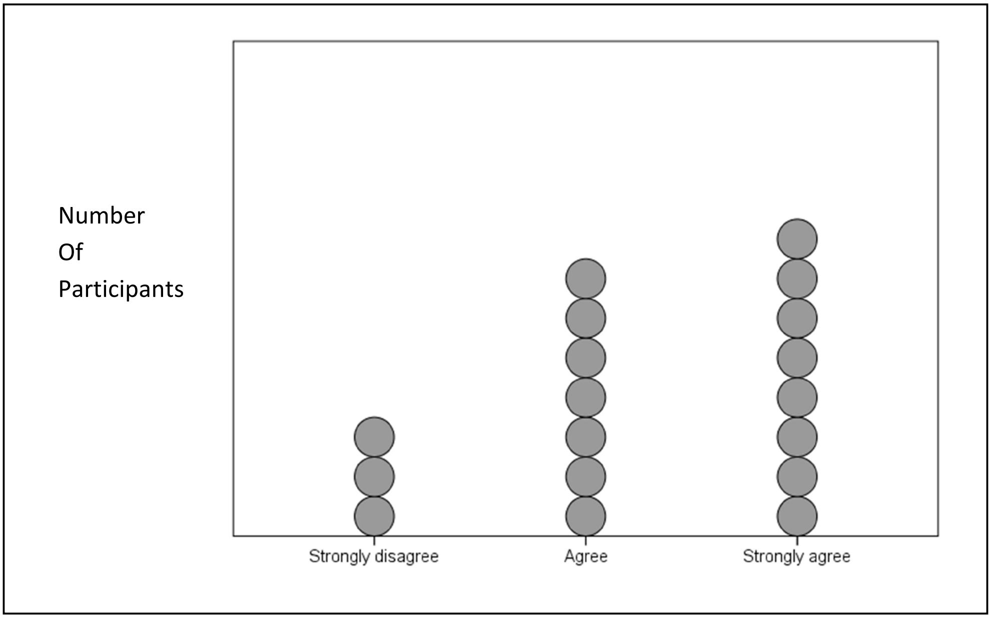


Figure 5: Motivation in doing mathematical accounting calculations

The overall results indicated that most of the participants agreed with the statement, while a minority of the participants did not.

The participants gave the following reasons.

> Makes me feel intelligent, gives me confidence and makes me feel smart (Bima).
>
> I feel happy because that is when I pick up information and tips for my understanding of the calculation. I have already attempted the calculation before, when the teacher performs it I am then able to correct my mistakes (Asiya).

When the teacher models the process or steps, the students are likely to learn from the process and reflect on it.

> It gives me the motivation to go on solving other problems. I get the confidence I need to do other problems (Sisi).
>
> Yes, I do get motivated and feel determined to work hard in order to improve my understanding (Khoba).
>
> Since I like to work with numbers, I always become motivated, happy when I got the right solution because I love accounting. I sometimes assist my friends with calculations. (Sibo)
>
> … get lost in the middle of the calculations … get frustrated … mathematical calculations, it is as if you are challenging the teacher … decide to keep quiet even if they do not understand (Phindi).

Students sometimes believe that asking a teacher to explain can be misinterpreted by the teacher, as if students are challenging the teacher's mathematics competence. However, if they want clarification and get a sense that their question is being misconstrued, they resolve to be quiet. Teachers must make a distinction between questions that indicate misunderstanding and questions that are testing the teacher's competence.

5. DISCUSSION OF RESEARCH RESULTS

The mean scores are positive – above average – however, many students had low scores in the factors. The wide spread of scores in Fennema-Sherman Confidence and Motivation in doing mathematics scales indicate that these factors may differ in significance in influencing the learning of accounting by pre-service teachers. This assumption is discussed below, drawing on the results of Fennema-Sherman Motivation and Confidence in doing Mathematics scales, the student interviews and the literature.

5.1 Effectance motivation in doing mathematics domain

The students were not discouraged by difficult mathematical problems, which indicate that the challenges of mathematics motivate them. As it was found during the interviews, these students were positively influenced by parents to persevere when faced with challenging mathematics problems. These students were also positively influenced by teachers who gave them tangible rewards (certificates) and intangible rewards (public acknowledgement). These students were intrinsically motivated because they have high autonomous (independent) learning. This finding is supported by Frazier-Kouassi (1999).

The majority of the participants agreed that watching and listening to the teacher in an accounting class performing a calculation presents a space for personal reflection. One major reason given by participants was that when the teacher models the process or steps the students are likely to learn from the process and reflect on it in their own approach. This finding corresponds with Erdogan *et al.* (2011) that teachers should begin with problems that students understand and solve easily because this may raise the self-efficacy beliefs of students and the teachers can then solve more difficult problems with the students. Only six participants were neutral in regard to the statement that "Watching and listening to the teachers in an accounting class performing a calculation presents a space for personal reflection." A reason given by participants was that when one asks a teacher to explain the process or steps the question could be misinterpreted by the teacher as challenging the teacher's mathematics competence; a student wants clarification then gets a sense that the teacher is misinterpreting the question and decides to be quiet.

The participants reflected a need for teachers to make use of the classroom environment as a resource for motivation. This result supports the findings by Aruwa (2011). To alleviate mathematics anxiety and increase the motivation level of students, teachers could use top achievers in mathematics as a resource to show easier mathematical accounting calculation methods. These top students benefit by having their abilities affirmed and by learning that they can become a resource for other learners. This finding is consistent with the finding by Vandecandelaere *et al.* (2012) that the learning environment is linked with the motivation that comes with enjoying the challenges in mathematics. One participant indicated that students in her class were uncomfortable and "not confident to ask questions in front of other learners". This fear of asking questions lowered students', self-esteem and personal self-belief. Another participant identified a serious issue facing teaching and learning: she felt that it is essential to understand a theory and set a theoretical foundation before applying it. Consequently, if the students' theoretical knowledge is solid, there will be less anxiety in the application of theoretical knowledge. Studies by Anthony (2000) and Aruwa (2011) found that self-motivation influenced success in mathematics subjects, that lack of effort was the most likely reason for failure in mathematics subjects and that it appeared to have influenced participants' achievement and attitudes towards mathematics.

5.2 Confidence in doing mathematics domain

Just two exceptional cases were found where the two participants were confident or enthusiastic in performing mathematical accounting calculations but had a negative disposition towards certain areas of mathematics that affected their learning in accounting. A total of 111 respondents (43.7%) agreed that, for one reason or another, even though they study, mathematics is really hard for them, and 115 agreed that they do fine in most subjects but mess up when it comes to mathematics. It is worrying that the majority of the participants showed lack of confidence in mathematical accounting calculations and rely on assistance from others. They indicated that they become anxious when performing mathematical accounting calculations. This finding is supported by Pajares and Schunk (2001) who found that students with low self-efficacy beliefs tend to be less confident and consequently become more anxious and stressed when attempting tasks.

5.3 Relationship between effectance motivation and confidence in doing mathematics and achievement in accounting

In first-year accounting, there were low positive and significant connections between accounting 210 and 220 achievement and motivation in doing mathematics as well as confidence in doing mathematics. In fourth-year accounting, strong positive and significant connections were found between motivation in doing mathematics, confidence in doing mathematics and achievement in Accounting 420. When students enter their fourth year, there is a relationship between motivation and confidence in doing mathematics and achievement in Accounting 420. Students want to complete their accounting as this is their final year of accounting.

6. CONCLUSIONS AND IMPLICATIONS FOR HIGHER EDUCATION

The quantitative results revealed that more positive attitude towards effectance motivation in doing mathematics came from Indian, English and suburban students ($p<0.050$). Many of the interview participants agreed that watching and listening to the teacher in an accounting class performing a calculation presents a space for personal reflection. The quantitative results also showed that students have equal positive attitude to confidence in doing mathematics ($p>0.050$), whereas the qualitative results disclosed that the majority of the participants lack confidence in mathematical accounting calculations and rely on assistance from others.

There is a relationship between motivation and confidence in doing mathematics and achievement in fourth year, Accounting 420. Students doing fourth year accounting want to complete their accounting studies as this is their final year of the BEd accounting programme.

It is suggested that students in their BEd first year do the foundation courses such as Mathematics for Accounting before registering for an accounting major module in their second year. This mathematics module will ease the transition between high school mathematics and the university mathematics required in accounting. In this way, students will be introduced to new ways of thinking and to useful methods for tackling accounting calculations, thereby becoming motivated in doing mathematics. This will enhance mathematical confidence of weaker students and the confidence of the better students will be markedly higher.

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